

Final Report
2004 - 2005
California Space Grant Consortium
Final Report for NASA NGT5-40085

Dr. John Kosmatka, Principal Investigator
Dr. Wolfgang Berger, Previous Principal Investigator
California Space Grant Consortium
University of California, San Diego
La Jolla, California 92093 -0085
Tele: (858) 534-1779
FAX: (858) 534-7840
E-Mail: jkosmatka@UCSD.edu

Dr. Michael J. Wiskerchen, Director
California Space Grant Consortium
University of California, San Diego
La Jolla, California 92093 -0524
Tele: (858) 534-5869
FAX: (858) 534 -7840
E-Mail: mwiskerchen@UCSD.edu

Introduction and Consortium Improvements

The California Space Grant Consortium (CaSGC) is California's implementation arm of the congressionally mandated (Public Law 100-147) NASA National Space Grant College and Fellowship Program. The CaSGC received Space Grant designation in 1989 and is administered by its Lead Institution, the University of California, San Diego (UC San Diego).

The Space Grant College and Fellowship program in California has expanded its impacts each year with Program Element projects at affiliate member and associate member institutions. The CaSGC is presently comprised of the following higher education affiliate members:

- UC Berkeley
- UC Los Angeles
- UC Santa Cruz
- San Diego State
- CSU Los Angeles
- Stanford University
- UC Davis
- UC San Diego
- UC Riverside
- CSU Sacramento
- CSU San Bernardino
- Santa Clara University
- UC Irvine
- UC Santa Barbara
- CSU Long Beach
- CalPoly-San Louis Obispo
- Univ. So. California
- Grossmont-Cuyamacha College

The following associate members participate on a project-by-project basis:

- San Jose State
- Univ. of San Diego
- Astro Soc. of Pacific
- CalPoly-Pomona
- CalTech
- San Francisco Art Institute
- SD Supercomputer Center
- Pomona College
- CSU Fresno

The organizational and administrative structure of the CaSGC has the Consortium Headquarters Office (Principal Investigator – Dr. John Kosmatka, California Statewide Director - Dr. Michael Wiskerchen) at UC San Diego. Each affiliate member institution has a campus director and an scholarship/fellowship selection committee. Each affiliate campus director also serves on the CaSGC Advisory Council and coordinates CMIS data collection and submission. The CaSGC strives to maintain a balance between expanded affiliate membership and continued high quality in targeted program areas of aerospace research, education, workforce development, and public outreach. Associate members are encouraged to participate on a project-by-project basis that meets the needs of California and the goals and objectives of the CaSGC. Associate members have responsibilities relating only to the CaSGC projects they are directly engaged in. Each year, as part of the CaSGC Improvement Plan, the CaSGC Advisory Council evaluates the performance of the affiliate and associate membership in terms of contributions to the CaSGC Strategic Plan. These CaSGC membership evaluations provide a constructive means for elevating productive members and removing non-performing members.

This Program Improvement and Results (PIR) report will document CaSGC program improvement results and impacts that directly respond to the specific needs of California in the area of aerospace-related education and human capital development and the Congressional mandate to “increase the understanding, assessment, development and utilization of space resources by promoting a strong education base, responsive research and training activities, and broad and prompt dissemination of knowledge and technology”.

The results of the 15th Year Evaluation were useful to the CaSGC in recognizing both its strengths and weaknesses. The CaSGC is building on its recognized strengths in human capital development, research infrastructure, and active partnerships with NASA Centers. Key human capital and research partnerships have been instituted in California involving NASA Dryden Flight Research Center (DFRC) and Ames Research Center (ARC). These CaSGC-lead efforts are impacting Space Grant Consortia across the country and are beginning to be replicated at other NASA Centers.

The 15th Year Evaluation also provided insight into where the CaSGC could make improvements that uniquely support California's needs in aerospace-related education and human capital development. The CaSGC Improvement Plan was structured to address the following key areas:

1. Characterizing the unique California needs in each of the CaSGC Program Element areas;
2. Identifying the significant and unique contribution the CaSGC can make in each of these Program Element areas;
3. Clearly defining the CaSGC funding strategies and priorities for each Program Element, identifying the goals to be achieved, and documenting the unique CaSGC impacts, outcomes, and trends;
4. In Program Element partnerships (where CaSGC is a minor facilitating and coordinating partner), identifying the CaSGC's goals, specific roles and responsibilities, metrics for assessment and evaluation, and carefully document CaSGC specific impacts;
5. Addressing diversity issues in terms of California needs and demographics and stating the CaSGC specific goals and objectives, metrics for assessment, and specific impacts;
6. Clearly defining the assessment and evaluation approach (set of metrics) for consortium membership (adding and dropping affiliates).

The core of the CaSGC Improvement Plan was structured to identify and document California's specific needs in areas of aerospace-related education, workforce development, research, and outreach and then establishing realistic goals and objectives for CaSGC in addressing those needs. This Plan includes a quantitative assessment and evaluation process to track CaSGC specific impacts, outcomes, and trends.

California presents unique challenges and opportunities to Space Grant. Its large size (population & aerospace economy), diverse ethnic population, strong NASA involvement (3 NASA Centers - ARC, DFRC, and JPL), and complex educational infrastructure create an environment unlike that of any other state. Although the CaSGC is very aware of its Congressional mandates for aerospace education, workforce development, and outreach and the goals in NASA's Strategic plan, the annual Space Grant funding dictates that the CaSGC adopt a management/operations strategy within its Strategic Plan that includes:

- Budgetary emphasis on Higher Education scholarships and fellowships;
- Providing only "seed" funding for research infrastructure and facilitating partnerships (matching funds from partners) between industry, government, and academic partners;
- Providing only "seed" funding for aerospace science and engineering curriculum development at the higher education level (matching funds from academic institutions);
- Forming community partnerships for K-12 and public outreach projects -- CSGC plays "only" a facilitating and aerospace content provider role;

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- Providing a coordination and facilitating environment between academia and NASA Centers for partnerships in research, workforce development (Human Capital), and education at all levels (non-Space Grant Project funding)

This strategy has enabled the CaSGC to begin to address the Human Capital crisis within NASA Centers and the aerospace industry and be viewed as a beneficial community partner on K-12 and public outreach issues. The CaSGC Improvement Plan focuses the above efforts in such a way as to address the unique aerospace needs of California.

Implementation of the CaSGC Improvement Plan

In September 2004, the CaSGC put a process in motion to develop a Strategic Plan that addressed the six key improvement areas: 1. Characterizing the unique California aerospace needs; 2. Identify where CaSGC can make an impact; 3. Set funding strategies and priorities, identify the goals, and document the impacts, outcomes, and trends; 4. Identify the CaSGC's roles and responsibilities and metrics for assessment and evaluation in program partnerships with universities, government, and industry; 5. Characterize California's aerospace-related Science, Technology, Engineering, Math (STEM) and diversity issues and set CaSGC specific goals and objectives, metrics for assessment, and specific impacts; 6. Define the assessment and evaluation approach (set of metrics) for consortium membership (adding and dropping affiliates).

Improvement Plan Task	Accomplishments 10/1/04 –8/1/05	2003 – 2004 Analysis & Report	2005 – 2006 Implementation Tasks	Impacts and Outcomes
1. Characterizing CA's unique aerospace education and workforce needs	Needs survey completed – (3/05) goals set – Modified Strategic Plan under review	Adjusted Goals, Priorities, evals applied to 03-04 Report – Impacts documented 7/05	Adoption of Strategic Plan (11/05) – Full reporting to CMIS (3/06)	Goals and outcomes aligned with CA needs, Congress intent, & CaSGC (8/05)
2. Prioritizing and aligning CaSGC tasks to optimize impacts	Highest priority set (2/05) Human Capital grants & Scholarships	Priorities documented & reported in CMIS data (6/05)	Budget aligned with CaSGC priorities (4/05)	Impacts & Outcomes reported in CMIS (March each year)
3. Set funding priorities and document impacts, outcomes, & trends	Budget priorities set (3/05) – document impacts, outcomes, trends (9/05)	03 – 04 Report compares CMIS data to outcomes trends	05 – 06 CMIS report tracks impacts, outcomes, trends	Impacts & Outcomes reported in CMIS (March each year)
4. Specify CaSGC's role and outcomes for private – public partnerships	Assessed and documented all CaSGC partnerships (8/05)	Document (9/05) CaSGC roles & impacts for each 03-04 program	CMIS reporting will document CaSGC roles & impacts (3/06)	Impacts & Outcomes reported in CMIS (March each year)
5. Document CA's STEM & diversity issues for aerospace	CA's STEM & diversity roadmap documented (5/05) – Goals established	03-04 Report compared to goals – impacts documented 9/05	Track & report diversity & STEM data – show trends (3/06)	Annual goals vs. outcomes data provided (March each year)
6. CaSGC membership assessment & evaluation	Metrics set for adding & dropping affiliates 3/05) – Approved (5/05)	CMIS list of affiliates & associates changed (9/05)	Affili. & Associate members list updated on annual basis	Membership re-assessed on an annual basis in second quarter

All of the above CaSGC Strategic Plan modifications were presented to the affiliates in mid-May 2005. The overall recommendation was made to implement the changes and apply them to all future programs initiated by the CaSGC. It was also recommended that the Strategic Plan should be revisited each year in the second quarter to determine how well it is working and to optimize the impacts and outcomes.

CaSGC National Program Emphases

The CaSGC, being primarily comprised of California institutions of higher education, has placed a high priority on **Program Elements** relating to **Scholarships/Fellowships, Research Infrastructure, Aerospace "Human Capital" Development, and Higher Education Curriculum**. For the **Pre-College and Public Service and Outreach Program Elements**, the CaSGC affiliates take on more of a facilitating and support role by partnering with organizational entities that have Pre-College and Public Service and Outreach as primary budgetary responsibilities and have established evaluation and performance standards that the CaSGC adopts and follows. For these two elements the CaSGC affiliates form partnerships with these organizational entities allowing the CaSGC affiliates to focus their expertise and effort solely on providing aerospace-related content and access to NASA's rich science and technology application environment.

From CaSGC's formation in 1989, each CaSGC program element has been structured such that they address the set of crosscutting national program emphases: Diversity – Competitiveness – NASA Ties – Industry Relations – State Government Involvement. The 15th Year Evaluation pointed out that the CaSGC needed to clearly describe and document the specific and unique CaSGC goals, assessments, and quantitative impacts that fit within the California aerospace strategic plan and directly address diversity and program competitiveness issues.

In October 2004, the CaSGC initiated a process to document California's "needs and challenges" for aerospace-related programs in education, human capital (workforce) development, research, and public outreach. The starting point for this information was the state-directed California Council on Science and Technology annual reports and the California higher education systems' (UC, CSU, and CCC) systematic study that tracks California students (including under-represented groups) in their preparation for STEM education and careers. This coupled with the 2003-2004 California Space Authority's Strategic Plan (**Aerospace-related Workforce, Education, Research, Infrastructure Assessment**) provides a quantitative baseline to structure the CaSGC goals, objectives, and outcomes. The CaSGC has made the decision to carefully apply its limited budget to program elements that produce a unique and significant impact on **California's aerospace-related human capital and research**.

The central CaSGC theme that links all of the CaSGC Program Elements is California's aerospace "Human Capital" development. Each CaSGC project, whether relating to higher education curriculum, pre-college STEM education, student - mentor experiential learning, NASA Center intern programs, is driven by the need to have positive outcomes which impact California's and NASA's "Human Capital" pipeline issues. Through CaSGC's leadership the interactions with NASA's California Centers (NASA ARC, DFRC, and JPL) have produced significant contributions and outcomes to NASA's research and Human Capital missions.

Over the past two years the Program Elements of **Scholarships/Fellowships and Research Infrastructure** have actively and directly engaged all five-program emphases. The **Higher Education Curriculum** Program Element, by its academic nature, only indirectly addresses diversity and competitiveness (affiliate campuses have established diversity and competitiveness standards that CaSGC recognizes and follows) while interacting with NASA, industry, and state

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government organizations. A similar situation exists for the **Pre-college** and **Public Service and Outreach Program Elements** where CaSGC is only a supporting partner to other lead organizations (i.e., State, Federal, academic).

The **Scholarship** (undergraduate level), **Fellowship** (graduate level), and **Training Grant** (all levels) Element and the **Research Infrastructure** Element derive funding support from three areas: NASA Space Grant, Non-Federal, and Other Federal.

Funding Source	Scholarship/Fellowship		Research Infrastructure	
	2003 Yr	2004 Yr	2003 Yr	2004 Yr
NASA Space Grant	\$207,639	\$190,515	\$74,188	\$31,985
Non-Federal	\$247,485	\$90,448	\$2,079,355	\$2,360,000
Other Federal	\$95,854	\$119,856	\$1,405,000	\$1,591,000

In 2003-2004 significant progress has been made in enhancing "Human Capital" programs at NASA Ames Research Center (ARC - Education Associates Program) and at NASA Dryden Flight Research Center (DFRC - Aeronautics, Education, Research, and Operations (AERO) Institute). These CaSGC managed intern/experiential learning opportunities are open to Space Grant students from CaSGC affiliate campuses as well as Space Grant consortia across the nation. These NASA Center efforts interact strongly with both the education/training division as well as the research and flight project areas.

CaSGC's Diversity Goals and Projected Outcomes

It is obvious from the demographic diversity data collected for the CaSGC Strategic Plan that California has serious problems in the area of diversity for science and engineering disciplines (see Diversity Report Appendix). The general population shows a very diverse general population with Latinos comprising a large and growing segment of that population. The S & E diversity data indicates low participation of under-represented groups. This California S & E diversity problem has its roots in the K-12 education system. Every higher education institution in California has done studies on the K-12 problem and have shown that K-12 budget problems, large numbers of immigrants at the K-12 level, inadequate incentives for math and science teachers, and slow implementation of science standards is the cause.

In higher education, Space Grant faces a different set of problems in promoting science, engineering, and technical careers for all students and particularly students from ethnic minorities. The data indicates that of all the undergraduate students registered at California universities and colleges, less than 20% of those students are pursuing STEM majors or career paths. The ethnic data on those STEM-related students show percentages that are far from the ethnic statistics of the general public. On most of the CaSGC affiliate campuses, the scholarship opportunities for minorities are more abundant and of greater monetary value than Space Grant can provide. This coupled with the low percentage of minority S&E students on the university campuses creates a problem for Space Grant in achieving minority scholarship awards above 10% of the awards.

The question for the CaSGC is how to take all of this demographic information and set an achievable goal for diversity that fits within CaSGC resources and organizational structure. The

CaSGC has determined that the greatest impact at the higher education level can be achieved by implementing the following:

- ◆ Aggressively advertise the Space Grant scholarship opportunities on each affiliate campus and promote such opportunities to minority science and engineering organizations;
- ◆ Within the CaSGC budget limitations, seek out and partner with programs at affiliate campuses that provide resources for under-represented groups pursuing STEM career paths;
- ◆ Partner with NASA Center and industry programs that promote STEM career assistance to under-represented groups;
- ◆ Set target goals that are representative of the minority populations in STEM career paths at the affiliate institutions;
- ◆ Document and report the results in CMIS

Scholarships/Fellowships and Research Infrastructure - Diversity – Diversity has been major thrust of the CaSGC in its recruitment and/or participation of women, underrepresented minorities, and persons with disabilities throughout all aspects of its STEM-related fellowship/scholarship programs and associated research infrastructure programs. All CaSGC affiliates have programs for recruiting/retention of underrepresented groups to STEM career paths. CaSGC partners with those ongoing efforts and provides scholarships/fellowships and research experience training grants. The NASA ARC intern program (EAP) continues to be successful in recruiting underrepresented faculty, post-doctoral, graduate, and undergraduate participants by announcing the program nationally through the 52 Space Grant consortia. Over 2003-2004, the awards given to women have averaged **27.5%** while underrepresented minority awards have averaged **25%**. CaSGC had a goal of greater than 20% each year that exceeds the percentage of under-represented students pursuing STEM careers at the university level in California (see Diversity Report in Appendix).

Scholarships/Fellowships and Research Infrastructure - Competitiveness and Accessibility – Each award in this Program Element follows a set of guidelines established by NASA and the CaSGC Advisory Council (see Appendix Section):

- AO and application guidelines for each program are given to all potential participants through websites or campus postings resulting in a competitive selection of recipients.
- Locally encourage (through underrepresented group office on each affiliate campus) space STEM students, particularly underrepresented ethnic or gender groups, to apply;
- Each affiliate campus is asked to accept responsibility for announcing the Space Grant opportunity, administering the competitive selection process, and tracking the results.

Scholarships/Fellowships and Research Infrastructure - NASA Ties, Industry Relations, State Government Involvement – The CaSGC has derived additional resources through the private/public alliance student/mentor projects and experiential learning intern programs administered by the Space Grant Foundation and involving the NASA Centers. The University of California's (CalSpace) Center of Excellence partnership has produced significant state funding for graduate fellowships on six UC affiliate campuses. The CaSGC has developed a broad spectrum of programs that intersect with NASA research efforts both at the universities and NASA Centers. These hands-on projects involving NASA Centers, California agencies, and industry have created the funding and mentor support for participation of a diverse student population.

Program Elements

1. Consortium Management

The CaSGC was founded in 1989 by three campuses of the University of California (UC San Diego, UC Los Angeles, UC Berkeley) under the direction and leadership of the California Space Institute (CalSpace - Multi-Campus Aerospace Research Institute of the University of California) at UC San Diego (lead institution). Higher Education Affiliates have been designated as **Founding Members, Fellowship Members, and Associate Members**. In 2005 the CaSGC Improvement Plan changes the membership classes to **Affiliate Members and Associate Members only**. Over the years since the CaSGC formation, each affiliate member was held responsible (in terms of management, reporting, etc.) for the activities that Space Grant helped sponsor. Institutions receiving \$40K or more per year were given full responsibilities for the full spectrum of Space Grant responsibilities including the provision of matching funds to the annual Space Grant proposal budget (Founding Members).

The **CaSGC organizational and administrative structure** has the Consortium Headquarters Office (Principal Investigator – James Arnold (1989 - 2001) - Wolf Berger in 2002 – 2005 – John Kosmatka in 2005, California State-wide Director - Michael Wiskerchen (100% time), and Assistant Coordinator/CMIS Contact – Irene Xavier (50% Time)) at UC San Diego (UCSD). The lead institution (UCSD) is assisted by a campus director at each of the participating affiliate institutions, a curriculum development committee with key membership from UC San Diego, UC Los Angeles, and UC Berkeley, and a graduate fellowship selection committee at each of the graduate fellowship campuses (University of California campuses at Berkeley, Davis, Irvine, Los Angeles, Riverside, San Diego, Santa Barbara, and Santa Cruz), Stanford, and San Diego State University.

The University of California System has waived all indirect cost on the NASA Space Grant and provides the majority of match funds. The CaSGC facilities at UC San Diego consist of a suite of six offices (140 sq. ft each) and a student – mentor projects laboratory (750 sq. ft) in the Chemistry Research Building. Under the CalSpace/CaSGC Center of Excellence program office space is provided for a campus director and education staff at 6 UC campuses (UC Berkeley, UC Davis, UC Santa Barbara, UC San Diego, UC Santa Cruz, UC Los Angeles). CalSpace also provides support to the CaSGC for web file servers, network support services, and technical maintenance.

In 2003 – 2004, the affiliate institutions with **Founding Member** status included UC San Diego, UC Los Angeles, UC Berkeley, UC Santa Barbara, UC Santa Cruz, and UC Davis. In addition to Founding Member status, each of these University of California campuses is an active participant in the California Space Institute's (CalSpace)/CaSGC Centers of Excellence (CoE) partnership. The CaSGC/CalSpace CoE partnership was instituted in 1999 to facilitate and coordinate the development and operation of aerospace-related Centers of Excellence on each of the University of California campuses. These Centers of Excellence not only foster world-class aerospace research but also provide an effective shared resources environment (10 – 1 match to Space Grant) for Space Grant education, outreach, and workforce development. The CoE's were

initiated through the mechanism of a signed Memorandum of Understanding (MOU) between the CaSGC, CalSpace, and the individual University of California campuses. As a signer of the MOU, the CaSGC coordinates and manages the aerospace-related education, outreach, and workforce parts of the COE activities on each respective campus.

Fellowship Members were added each year when at least \$10,000 in Space Grant graduate fellowship funding is available from the CaSGC. UC Irvine and UC Riverside are Fellowship Members using this process. Slow growth of Space Grant funds over the past 10 years has not allowed for any increases in Fellowship Members in 2003 - 2004.

Most **Associate Members** are brought into the CaSGC on the basis of special projects that range from curricular projects at the K-12 and university levels, to research projects, and student/mentor flight projects. The CaSGC seeds these programs by providing either direct Space Grant funding or coordinating support. At the initiation of the projects, these institutions were made Associate Members of the CaSGC.

The CaSGC statewide advisory committee (all affiliates) meets once a year to set priorities on distribution of Space Grant funds, joint project efforts, and outside (NASA Space Grant) resource development. Day-to-day management and information exchange is carried out electronically through the CaSGC web site, e-mail, and by telephone. Collection of CMIS data is also done through the CaSGC web site and e-mail.

The CaSGC has been assisted greatly by the establishment of the California Space Grant Foundation in the later part of 2001. The California Space Grant Foundation (CaSGF) (<http://www.csgf.org>) is a California 501(c)(3) not-for-profit corporation representing all affiliate members of the CaSGC. The CaSGC Director, Michael Wiskerchen, is the Executive Director and Chairman of the Board for the CaSGF. The CaSGF programs incorporate the following key elements:

- Provide a contracting and management environment for strong aerospace industry and government sponsorship and participation of mentors, facilities, and ideas in CaSGC programs;
- Facilitate and provide day-to-day management between NASA and the CaSGC affiliate universities and colleges for aerospace-related research and development (R&D), workforce development, and educational outreach;
- Work closely with the National Space Grant Foundation on Space Grant Projects of a nation-wide nature;
- Create alliance partnerships (shared responsibilities, personnel, and facilities) between the government, Space Grant affiliates, and industry participants and provide the operational interface, both management and contractual, between industry and the NASA projects;

The CaSGC has taken the position that affiliates are primarily institutions of higher education. Industry and government organizations are brought on-board as partners on a project-by-project basis. These projects consist of student - mentor science and engineering activities, educational programs, workforce development, and outreach activities. The CaSGC continues to be very successful in establishing these industry, government, and academic partnerships. The

cooperative agreement partnerships between the California Space Grant Foundation and NASA ARC and NASA DFRC are opening new opportunities for innovative projects for R&D, workforce development, and hands-on student - mentor efforts for all of the CSGC affiliates as well as Space Grant consortia across the nation. These efforts also involve key state, regional, and local government agencies concerned about aerospace workforce and economic development.

Expansion/Contraction of CaSGC Affiliates Members

During 2003 - 2004, the CaSGC expanded to 27 affiliates. Most are large higher education institutions with large NASA related research programs. Most also have large outreach and recruitment/retention programs for underrepresented groups (minorities and women) and are designated as "Minority Serving Institutions". The participation of Founding Members and Fellowship Members in all aspects (including match funds) of the CaSGC program elements has been consistently good even though the percentage of CaSGC funds has been relatively small. In response to the 15th year review the CaSGC developed a set of guidelines to evaluate the performance and responsiveness of each affiliate Member. This has resulted in a number of changes in the CaSGC membership in 2005 that reduces membership to only two classes of members – **Affiliate Members** and **Associate Members**.

The CaSGC Advisory Council has determined that each Affiliate and Associate Member should be evaluated annually for their contributions to the CaSGC goals and objectives. If there are two consecutive years of non-participation the affiliate should be removed from the consortium. The removed affiliate does have the opportunity to be reinstated if they agree to accept the recognized affiliate responsibilities. As new funding appears (usually for a specific project) the advisory committee evaluates the addition of new affiliates. Since any new project funds usually have specific goals and objectives attached, new affiliates must provide unique capabilities and skills to be considered as a new affiliate. Space Grant funding (Approx. \$100K/year) has been allocated for seeding affiliate projects (student/mentor workforce development K-12, flight projects, curricular projects, Outreach projects, etc.) through an Announcement of Opportunity process. The AO process, proposal (no more than three pages), and selection by a small peer review panel are kept efficient and functional. The topic of membership is reviewed each year by all of the affiliates in an annual meeting.

CaSGC Affiliate Diversity – Participation of Minority Serving Institutions

California has the largest number of higher education institutions (10 University of California Campuses, 23 California State University campuses, more than 100 Community College campuses, and numerous private institutions) of any state or country. California has few institutions that are classified as a minority institution (0-HBCU, 0 – Native American, etc.) but has over 50 that are designated (Department of Education) as minority serving institutions. The CaSGC presently has 9 affiliates classified as minority serving institutions, 3 Hispanic Serving Institutions (HSI) and 4 more minority serving institutions that have partnered on various CaSGC projects. With the development of the NASA ARC Education Associates Program (126 institutions across the U.S. have participated) and the NASA DFRC AERO Institute (many

minority serving institutions are being engaged), the CaSGC has been and will continue to make significant progress in diversity among its affiliates and partners.

CSGC Collaborative Decision Making

Over the 2003 - 2004 years the annual NASA Space Grant funds for California has remained at a baseline level of \$475,000. Although many of the budget decisions are pre-determined by steady state NASA funding (i.e., at least \$100K for graduate fellowships, program management salaries, etc), all of the affiliates participate in setting priorities for available funding that is over these designated budget amounts (i.e., Workforce Development awards). On all budgets derived from private or State support, every affiliate member has a full voice in the decision-making. Every affiliate member has equal voting status in determining the priority of resources allocated for various program areas. They are also fully engaged in setting priorities in pursuing funding from private and/or State sources. The table below details the 2003 -2004 funding from sources other than NASA Space Grant.

Match and Other Federal Funds (Cash and Non-Cash)

Funding Source	2003	2004	Funding Source	2003	2004
Lead Institution	\$ 1,638,509	\$ 728,708	Non-Profit Org.	\$ 124,150	\$ 160,000
Academic Affiliates	\$ 1,067,988	\$ 1,537,940	Participants	\$ 300	\$ 0
Industry	\$ 1,147,924	\$ 1,449,000	Other	\$ 47,982	\$ 4,000
State Government	\$ 1,064,539	\$ 814,039	Total	\$ 10,742,546	\$ 11,987,543
Other Federal	\$5,651,154	\$ 7,375,856			

The distribution of NASA Space Grant funds between program areas is given in the table below. The emphasis is placed at the higher education level (following the CaSGC Strategic Plan) dominated with funding for undergraduate scholarships and graduate fellowships. The University of California has waived all indirect costs for the NASA Grant.

Program Allocation - NASA Space Grant Dollars

Program Element	2003		2004	
Fellowships	207,615	34.90%	190,515	35.70%
Research	74,188	12.50%	31,985	6%
Higher Education	104,175	17.50%	76,500	14.30%
Precollege	13,672	2.30%	14,000	2.60%
General Public	16,500	2.80%	12,000	2.25%
External Relations	10,350	1.75%	10,000	1.90%
Indirect Costs	0	0%	0	0%
Consort. Admin Costs:	168,500	28.30%	190,000	36.1%
Total	595,000	100%	525,000	100%

Program Element allocation is greatly influenced by other Federal, State, and industry funding. Industry heavily funds research and external programs while the state educational systems funds higher education (faculty salaries, curriculum development, and facility services). Also outside funding provides funds for university indirect costs and also some of the consortium's administration costs.

CaSGC Management Challenges

The CaSGC influence and impact is growing exponentially but its baseline NASA budget is remaining constant or dropping. The Space Grant programs (research and workforce development) with NASA Centers (especially NASA ARC and NASA DFRC) are expanding rapidly and subsequently are demanding considerable management attention. With these expanding efforts, pressure is exerted on CaSGC management to increase the number of quality affiliates. With the increased number of projects and affiliates comes the responsibility to document and report CMIS data.

2. Fellowship/Scholarship Program

The CaSGC Scholarship (undergraduate) and Fellowship (graduate) Program is active throughout California at the Space Grant affiliate institutions as well as NASA Centers (NASA JSC, ARC, DFRC, and GSFC). This Program Element is the highest priority within the CaSGC Strategic plan and is being presently structured to respond to NASA’s Strategic Human Capital Implementation Plan. Funding for the 2003 -2004 awards are derived from multiple sources including NASA Space Grant (annual 2 yr. av. of \$198,000 or 35% of consortium budget), private organizations, and State and Federal agencies. Each year the CaSGC sponsors an array of competitive scholarship/fellowship/training grant programs for qualified students at the California Space Grant affiliate campuses.

The distribution of Scholarship/Fellowship funds (CaSGC CMIS table below) from both NASA Space Grant and other sources is given to both CaSGC affiliates but also to other consortia throughout the nation. The distribution is influenced greatly by the fact that Space Grant funds have remained relatively constant for 10 years and other funds are derived from private and public sponsors of student – mentor projects or research projects. In the case of outside funding, the institutional teams surrounding each research or student – mentor project help define and designate the institutions involved. The Scholarship/Fellowship funding derived through the NASA Center programs (NASA ARC and NASA DFRC) have grown each year. **The CaSGC, as part of the Improvement Plan, has created a process to collect data on Scholarship/Fellowship awardees that tracks them for one year past graduation. Annually, this data will be reported to CMIS and will be placed on the CaSGC website.**

Scholarship/Fellowship Funding Distribution to CaSGC Affiliates from all Sources

CaSGC Affiliate	2003	2004	CaSGC Affiliate	2003	2004
San Diego State	10,000	20,000	UC Riverside	12,000	10,840
San Jose State	6,600		UC San Diego	126,342	97,286
Santa Clara	10,000	10,000	UC Santa Barbara	63,000	34,115
Stanford	70,000		UC Santa Cruz	28,615	12,000
UC Berkeley	24,000	20,000	Calpoly SLO	10,000	0
UC Davis	15,000	30,000	Univ. S. Cal	10,000	8,000
UC Irvine	12,000	10,000	Long Beach		10,000
UC Los Angeles	153,397	153,528	Total	550,954	416,769

Graduate Research Fellowships

Each year the CaSGC provides direct Space Grant support for aerospace-related graduate fellowships to affiliate campuses. These graduate student fellowship opportunities are announced each year through the local Space Grant affiliate campus office. The fellowship awards are for graduate students in aerospace-related science, engineering and technology. Each participating affiliate is given a set of guidelines for administering the fellowships. The program has acted as a catalyst to focus student attention on the science and engineering opportunities involved in the U.S. aerospace program. The Fellowship Program guidelines are as follows:

- Annual total California Space Grant Graduate Fellowship awards exceed \$100,000;
- Graduate students must be U.S. citizens for Space Grant awards;
- Each campus director (Fellowship affiliate campuses) forms a local selection committee that makes the selection and administers the competitive fellowship program;
- Each affiliate campus announces to and encourages aerospace science and engineering graduate students, particularly underrepresented ethnic or gender groups, to apply;
- Each award recipient is encouraged to mentor within the campus minority engineering and science programs and in the Space Grant Outreach programs;
- Each affiliate must track, assess, evaluate, and report the outcomes and impacts of the program.

In addition to the Space Grant sponsored fellowships, the CSGC coordinates graduate student opportunities involving student - mentor projects with industry and the government. The CaSGC also works in close cooperation with the California Space Grant Foundation in providing graduate student opportunities as research interns at NASA Centers.

Workforce Development Scholarships/Training Grants

The CaSGC has initiated and supports aerospace workforce development efforts that involve science, engineering, and management student teams (graduate and undergraduate level) in hands-on aerospace projects. These programs were created to provide students with practical experience and Scholarships/Training Grants while under the guidance of mentors from the industrial, academic, and government sectors. These opportunities are widely announced within California and for some projects nationally and students are selected for scholarship/training grants on a competitive basis.

The CaSGC student-mentor efforts are growing and are meeting the CaSGC goals. Each of these student-mentor programs demonstrate baseline characteristics that industry, NASA, and the California Agencies have realized are critical for solving the high technology workforce problems in California and the nation. Those baseline characteristics are as follows:

- Team participation of students from K-12, undergraduate, and graduate levels (pipeline);
- Experiential learning through "real" aerospace-related projects
 - Highest priority given to workforce skill development of students & mentors
 - Emphasizes students experiencing mission life cycle (define, design, build, fly, analyze)
- Community-based private - public partnerships
 - Involves industry, government, and academia for mentors, facilities, and investment

- Addresses "Human Capital" issues of the State and Federal Government

Research Intern Program at NASA Centers (NASA ARC and DFRC)

The NASA ARC Education Associates Program is designed to provide university students and faculty with experiential learning opportunities in the space sciences, engineering, science administration, and related fields at Ames Research Center. The program also supports NASA's science education and training missions and addresses the national need to develop a cadre of trained professionals with competencies in a wide variety of aerospace and related disciplines. Over the past six years, over 600 students and faculty from some 132 different Space Grant colleges and universities around the nation have participated. They have worked with 250 different ARC sponsors and mentors on projects in every branch of ARC. Both the National and California Space Grant Foundations have accepted the responsibility to administer the program for the mutual benefit of the Space Grant participants and NASA.

NASA DFRC and the California Space Grant Consortium (CaSGC), in collaboration with the California Space Grant Foundation (CaSGF), have formed a cooperative partnership in order to enhance the education and training of students and increase the relevance of CaSGC training and research programs to DFRC's mission. This cooperative program is intended to provide a significant positive impact on the following areas:

- The quality of science and technical education;
- The relevance of CaSGC programs to DFRC's mission; and
- The number of underrepresented students electing to pursue graduate study and research careers in science, technology, and mathematics.

The overall aims of the program are to provide a mechanism for the development of activities that will lead to the strengthening and growth of mutually beneficial educational, scientific, Human Capital, and technical programs conducted jointly and independently by CaSGC and DFRC. The 2003 - 2004 CMIS data tables for the CaSGC Fellowship/Scholarship Program are given below.

Awardees	2003	2004	Awardees	2003	2004
Underrep. Males	16	24	% Awards to Underrep.	21%	30%
Underrep. Females	10	4	% Awards to Females	33%	20%
Total Underrep.	26	28			
Non-Underrep. Males	67	50			
Non-Underrep. Females	31	15			
Total Non-Underrep.	98	65			
Total Unreported	0	0			
Total Awardees	124	92			

Since these figures are derived from both graduate (Fellowship) and undergraduate (Scholarships) awards, they represent significant values as compared to the demographics of students pursuing STEM-related careers in California (see Diversity data in the Appendix section). This is particularly true for the graduate level where the number of underrepresented students in the STEM career paths is less than 20%. Also for undergraduate awards at universities not designated as minority serving institutions, the percentage of underrepresented students in STEM career paths is less than 20%. It was also found to be difficult recruiting

underrepresented minorities to Space Grant programs since the award amounts for graduate and undergraduate students was less than could be obtained from many of the other programs targeting underrepresented students in STEM career paths at the CaSGC affiliate institutions.

Award Levels and Amounts

Awardees	2003	2004
Number Undergrad	74	49
Number of Graduate	49	44
Unreported	0	0
Total Awards	123	93
Average Award Amount	\$4,443	\$4,374
Av. Undergrad \$	\$3,278	\$2,822
Average Grad \$	\$6,191	\$6,102

Alignment with NASA’s Human Capital Plan

In 2003 NASA has developed a definitive Strategic Human Capital Plan with stated goals, objectives, and measured outcomes and results. The Plan sets forth a framework that the CaSGC Fellowship/Scholarship/Training Grant program can be aligned with. As described in the Plan, the measurement and assessment processes are essential in aiding NASA in managing the Agencies Human Capital, identifying areas for increased emphasis, and assessing whether existing activities and initiatives are producing the desired results. A key objective in NASA’s Plan is to show “**Continuous progress in closing gaps in NASA’s critical competencies**”. The CaSGC will set the following goals within this Program Element to assist NASA in this objective:

- Prioritize Fellowships/Scholarships/Training Grants funding to correspond to NASA’s critical competency needs;
- Maintain percentage of awards to underrepresented groups (STEM career paths) to above 25%;
- Work with NASA Centers (NASA ARC and DFRC initially) to identify Competency gaps and set goals in closing gaps;
- Adopt metrics (NASA Metrics) and report outcomes and impacts to CMIS.

Impact/Results - The “Human Capital” programs described above have had significant and documented impact on both NASA and the aerospace industry. Students that have participated in these research experience and student – mentor programs are highly sought after by both industry and NASA. This has been particularly true for our intern programs at NASA DFRC and ARC. The CaSGC will continue to adopt NASA’s Human Capital metrics to evaluate the programs' success, impacts, and progress.

3. Research Infrastructure Program

California’s large aerospace-related research infrastructures revolve around the university systems and the Federal laboratories. California has four major higher educational systems – University of California (UC – 10 campuses) System, the California State University (CSU – 23 campuses) System, the California Community College (CCC – 116 campuses) System and a number of large and small private universities (Stanford, CalTech, USC, Santa Clara, Pomona,

etc.). Each of the State-funded Systems has unique charters (UC – BS, MS, & PhD degrees & major research, CSU – BS & MS degrees & applied research, CCC – community training, two year certification, and student transfer service to UC & CSU). The private universities cover the spectrum of educational services and research. With CaSGC’s relatively small budget in comparison to the ongoing NASA research efforts in California universities (approximately \$190M in 2003-2004), the CaSGC’s role must be focused solely on facilitating and coordinating educational and “Human Capital” aspects of aerospace-related research & development interactions between these institutions.

Most major research institutions have developed a culture that rewards research publications and producing PhD’s over other activities. With this in mind, the **CaSGC Strategic Plan** has focused its resources in the following areas:

- **Providing research Fellowships/Scholarships to CaSGC affiliates;**
- **Partnering with the Univ. of California (CalSpace) Centers of Excellence;**
- **Facilitating teaming arrangements between CaSGC affiliates on NASA Enterprise-related research programs;**
- **Facilitating and managing research project teaming between CaSGC affiliates and NASA Centers (NASA ARC, DFRC, JSC, JPL) and industry;**
- **Coordinating and managing student/mentor and faculty research experience programs at NASA Centers (NASA ARC, DFRC AERO Institute).**

The CaSGC has determined that the above facilitation, coordination, and management activities are the most productive way to significantly impact aerospace-related research infrastructure in California. Funding sources for the research infrastructure program in 2003-2004 are given in the table below.

Source	2003	2004	Source	2003	2004
NASA Funds	74,188	31,985	Graduate Student	2,079,355	1,110,000
Carry-over Funds	520,000	0	Undergraduate	1,405,000	270,000
Non-Federal	2,079,355	2,360,000	Total Support	3,484,355	1,380,000
Other Federal Funds	1,405,000	1,591,000			
Total	4,078,543	3,982,985			

The fluctuations in funding by various sources are primarily determined by the starting and concluding of various research projects. The CMIS database reports the overall funding for all projects that the CaSGC is a partner (partner refers to being on the project team in some capacity). In most cases the CaSGC’s role is to provide education and training coordination, facilitation and management services and/or provide student scholarships/fellowships (shown in Table below).

Tracking and documenting the complete set of statistical data (participant information, publications, etc.) for each of these research activities is difficult for CaSGC to accomplish. For CaSGC funded aspects of these projects, the CMIS data has been collected and reported thoroughly. Collecting detailed data from research projects funded primarily by sources other than Space Grant (which is the predominate case) is almost impossible to accomplish by the CaSGC since the Principal Investigators and funding agencies do not require such reporting. The CaSGC’s **Research Infrastructure Program Element** is highlighted by its University of

California (CalSpace) Center of Excellence Program and its student – mentor and faculty research experience programs at NASA Centers. These programs not only develop significant aerospace-related science and engineering R&D impacts but also address many of the Human Capital issues facing NASA and the NASA Centers.

CaSGC/CalSpace Centers of Excellence (CoE)

All six CaSGC/CalSpace Centers of Excellence (CoE) have conducted extensive NASA-related research in 2003 & 2004. The **UC Davis CoE** is focused on research to develop applications with remote sensing imagery that can be used to address the needs of agricultural and environmental resources managers. The **UC Los Angeles CoE** effort integrates solar physics, terrestrial geophysics, magnetospheric physics and planetary sciences. It is one of the broadest space science programs at any institution. It aligns closely with the Sun-Earth Connection and the Solar System Exploration Themes of the Space Science Enterprise. The **UC Berkeley COE** has a threefold mission: 1. Enable space-related research on campus in the areas of astrophysics and space sciences; 2. Train future space scientists through educational programs from elementary school through post-graduate research; 3. Foster interactions between the campus research community and aerospace industry. **UC Santa Cruz COE** has established the Center for Origins Studies (COS) for research in space science and engineering. It provides a bridge and a conduit for interdisciplinary research between astrophysics, earth science, physics, applied mathematics, and electrical engineering departments. **UC Santa Barbara COE** has a threefold mission: 1. Facilitate undergraduate research, teaching, and public education in fields related to space exploration and remote sensing from spacecraft; 2. Provide improved education, outreach, and workforce training in space technology and related applications; 3. Increase the speed and effectiveness of the transfer of technology and other innovations to industry that will enhance the economic competitiveness of California industries. **UC San Diego COE** has a threefold mission: 1. Foster scientific advances that help maintain the leadership role in the climate sciences; 2. Combine satellite remote sensing and aerospace technology with climate model simulation and major field measurement programs to advance global change research; 3. Provide improved education, outreach, and workforce training in satellite remote sensing and aerospace technologies, and related applications.

Cooperative Research Programs at NASA (ARC and DFRC)

NASA ARC -- Over the past five years the CaSGC has initiated two Cooperative Agreement research programs (Education Associates Program (discussed previously) and Student – Mentor Research Projects) at NASA ARC that provide opportunities for faculty and students to team with ARC researchers on projects the cross all of the NASA Enterprises. The Cooperative Research Student – Mentor Projects (i.e., Mars Sample Return Mission, Space Transportation System for Cargo) provides affiliate researchers the ability to team with ARC researchers and industrial partners on key NASA Enterprise research projects. Both programs provide ARC with a diverse population of eager, bright student, post-doctoral, and faculty researchers in support of ARC's varied scientific projects and missions.

NASA DFRC (Aerospace Education, Research, and Operations – AERO Institute) -- The AERO Institute was initiated in 2002 through a Space Act Agreement between NASA DFRC

and the California Space Grant. The overall goals of the program are to provide a cooperative research environment for Space Grant consortia to team with DFRC researchers on R&D projects critical to DFRC's mission. These projects are all linked to the strategic goals of the NASA Missions. This cooperative program was initiated to provide a significant positive impact on aerospace-related R&D programs involving industry, NASA DFRC, and academia. Metrics have been installed to measure progress in the program by tracking the number and character of research projects initiated, participant statistics, and positive impacts to NASA's Strategic Plan. Significant impacts are anticipated to increase in the next several years.

4. Higher Education Program

One of the highest priorities of the CaSGC is to develop an effective aerospace learning environment that has both curricular excellence as well as hands-on skill development efforts. Each of the CaSGC affiliates contributes to both areas throughout California. Over the past two years, almost every California Space Grant affiliate has initiated student/mentor projects covering some aspect of aerospace-related R&D, workforce development, education, and public outreach. Each of these curricular and student-mentor programs demonstrates baseline characteristics that the California aerospace community has realized are critical for solving the high tech workforce problems in California. To characterize the CaSGC **Higher Education Program Element**, three key affiliate (UC San Diego - UCSD, UC Los Angeles - UCLA, and UC Berkeley - UCB) programs are summarized for 2003 - 2004.

Description of CaSGC Higher Education Program – The primary goal of the CaSGC Higher Education Program is to improve learning in the Aerospace-related engineering and science programs at the CaSGC affiliate universities to the extent that CaSGC resources allow. Each affiliate contributes unique expertise in both aerospace-related science and engineering. There are only 69 universities in the US offering aerospace engineering degrees. Of those 69 schools, thirteen schools (19%) are in California, while Florida and New York have five schools each. Six states (Texas, AZ, MA, VA) have three schools each. Currently, there are approximately 2000 BS-aerospace engineering degrees awarded each year, where California produces more than 25% of the U.S. graduates. The CaSGC affiliates currently direct 12 of the 13 California aerospace engineering programs. From its formation in 1989 the CaSGC has emphasized undergraduate education as the area to achieve greatest impact by Space Grant with its limited resources. As the initial founding members of the CaSGC, UCSD, UCLA, and UCB have taken the lead in creating interdisciplinary undergraduate learning environments that include both engineering and science curricular programs and experiential learning student – mentor projects. Each of the curricular programs were developed and certified under stringent standards imposed by the University of California (UC) and national evaluation and certification organizations. In addition all curricular programs are review by the resident engineering and science departments on these affiliate campuses on an annual basis. Also, each affiliate coordinates these CaSGC efforts with the minority science and engineering programs on each campus. Similar programs have been initiated at the various CaSGC affiliate California State University campuses and private universities (Stanford, USC, and CalTech) using their own funds.

UCSD's Higher Education Program – In 1990 the lead institution (UCSD) developed an interdisciplinary capstone two-course sequence "(MAE 180A/B): Space Science and

Engineering.” that is jointly given by Aerospace Engineering and the Departments of Chemistry and Physics. The capstone course materials have been made available on the web for all affiliates. This early effort led to the creation of an Aerospace Science and Engineering minor in 1991 and to the university approval of a BS in Aerospace Engineering in 1992 along with the creation of seven unique aerospace engineering courses. Four of these courses (SE 160 A/B: Aerospace Structural Design, MAE 155A/B: Aerospace Engineering Design) were developed with CaSGC support. The first two graduates were in 1996, and in 2001 it became the newest ABET accredited aerospace engineering program in the state of California. The program is rapidly growing with 15 graduates in 2003, 55 graduates in 2004, and will have nearly 90 graduates in 2005. With its 300 undergraduates it is the largest aerospace engineering program in the University of California system. The Aerospace Engineering Mission Statement is: To prepare our students to be outstanding scientists and engineering leaders by emphasizing engineering fundamentals, principles of professional practices, and their integration into the design/development of advanced aeronautical and astronautical systems. Within this aerospace engineering program, CaSGC is supporting joint science and engineering student-mentor projects on Unmanned Air Vehicle (UAV) development for atmospheric climate modeling and global change research.

The Aerospace Engineering **Assessment and Evaluation** is achieved through a number of measures that assess the achievement and effectiveness of the educational objectives: 1. Alumni Survey (target: data from 3 and 5 year graduates); 2. Employer Survey; 3. JSOE CAP Survey; 4. Placement Data; 5. Graduate School Admissions. The Objectives are also evaluated in terms of the institution mission as well as current trends for evolving engineering skills and employment demands.

UCLA’s CaSGC Higher Education Program Characteristics -- The goal of the CaSGC Higher Education Program at UCLA is to improve learning in the Aerospace Engineering and Science programs. Generally, a new program is developed in a UCLA course and then offered to other universities. Projects have been concentrated in the areas of planetary physics and space science and associated engineering. This effort is supported partially by CaSGC mini-grants in which a faculty applicant applies for funds for a time-limited period to undertake a specific higher education project. Within the discipline areas mentioned, two principal types of projects have been most frequently proposed: software to assist with learning, either through visualization, computer simulation of physical processes, or computer aided instruction; and text book preparation. Some of the software developed by the Space Grant has received international awards and is being used worldwide.

The impact of the UCLA program can be judged by the sales of the major textbook that the program helped to underwrite and by the distribution of the software worldwide as well as the award it received. The program is particularly strong at the graduate level in part because at UCLA Space Science is a graduate program. In 2003 & 2004 UCLA affiliate has completed an undergraduate text in space science. Also a new introductory course (a general education course) in space weather has been instituted in 2004.

UCB’s CaSGC Higher Education Program Characteristics – In 2003 & 2004 the Berkeley Astronomy Department offers three undergraduate (UG) laboratory courses: an optical

astronomy lab (AY120), a radio astronomy lab (AY121) and an infrared astronomy lab (AY122). These are intended for, and are challenging to undergraduate majors and prospective majors, primarily in astronomy, but also in physics, engineering and geophysics. The CaSGC support contributes to staff and student support of the undergraduate lab and computing facility. Both science and engineering students are also given experiential learning opportunities to participate in student – mentor projects (Satellite Missions) that are designed, built, and operated out of the UCB Space Science Laboratory.

The table below shows the Higher Education funding sources across all affiliates. The NASA Funds show fluctuations from year to year based on the number of student – mentor projects supported by CaSGC. Although participant data collection is carefully done for CaSGC funds it is difficult to collect data for participants funded from other Federal or Non-Federal sources since this funding does not require data collection. The student support for Higher Education is applied mainly for student – mentor projects that involve both curricular development and experiential learning research and flight projects.

Higher Education Funding Sources			Higher Education Student Support		
Source	2003	2004	Source	2003	2004
NASA Funds	104,175	76,500	Graduate Support	954,000	1,583,000
Carry-over	115,000	115,000	Undergrad Support	1,083,000	1,745,000
Non-Federal	1,625,514	1,750,539	Total Student Support	2,037,000	3,328,000
Other Federal	2,993,300	4,570,000			
Total Funds	4,837,989	6,512,039			

5. CaSGC Pre-college Education Program

Each year the CaSGC supports (both management and a small amount of CaSGC funds) a number of pre-college activities throughout the State. The CaSGC has set a path for a small pre-college involvement that has the Consortium playing only an aerospace STEM-related coordination and facilitation role to the organizations on each of the affiliate campuses that have primary responsibility for pre-college curriculum development, teacher education, outreach, and assessment. In each of the pre-college projects initiated by one of the affiliate institution, the CaSGC affiliate provides assistance in the form of facilitating an interface to NASA education and research resources. This minor role is necessitated by the CaSGC’s limited budget for Pre-college programs.

Throughout California the CaSGC provides management support and a small funding assistance to the affiliate campus Teacher Education & Training and Outreach Programs. The K-12 education and outreach programs within the three large California higher education systems (University of California System- 10 campuses, California State University System - 22 campuses, and the California Community College System - 116 campuses) are immense programs serving a large K-12 pre-service and in-service teacher populations. State and National Standards for science and math curriculum guide each of these programs and each participates in annual evaluations and assessments. In addition, each of these institutions is carrying out numerous programs that focus on encouraging underrepresented pre-college students (minorities and women) to select STEM careers. The CaSGC affiliates are committed to partnering as much

as possible within resource limitations with these programs to influence the introduction of aerospace-related educational material and concepts to these programs.

While the established and existing programs under the California Higher Education Systems provide both the leadership and foundation for exceptional work in teacher education, educational technology, curriculum development and assessment, systemic reform, and quantitative tracking and evaluation, CaSGC provides unique space-related content and coordination capabilities. Into these ongoing pre-college programs, the CaSGC provides an interface to aerospace-related educational materials and resources and an opportunity for teachers and their pre-college students to be involved in NASA-related programs. The CaSGC budget for pre-college activities represents less than 3% of the total NASA Space Grant Funds and less than 10% of overall program funds. This aligns with the CaSGC Strategic Plan where university level programs are given higher priority. The table below shows all funding sources. This indicates that substantial resources are derived from other sources in which CaSGC partners.

Source	2003	2004
NASA Funds	13,672	14,000
Carry-over Funds	0	0
Non-Federal	69,667	179,000
Other Federal Funds	1,075,000	1,085,000
Total	1,158,339	1,278,000

Impact/Results -- The credible evidence of the impact of the CaSGC Pre-college Education Program is indicated by the growth both in the demand for CaSGC affiliate participation in university and informal education programs and the sharp increase in budget from outside sources. The main strength of the program is the extensive network of partnerships the CaSGC has forged with the K-12-related organizations within our universities, California Space Grant Foundation, and with NASA. The metrics used to determine the impact of the CaSGC Pre-college program consists of documenting the number of programs, workshops, partnerships, and participants for all of the CaSGC affiliates. Other more extensive metrics are used by our partner organizations that provide the major funding for these programs. Many of the metrics used are state or federally mandated. CaSGC affiliates only assist where we can in this assessment process.

6. CaSGC Public Service Program: General Public and External Relations

The CaSGC Public Service Program Element is structured to respond to NASA’s Strategic Plan -- **Mission III: “To Inspire the Next Generation of Explorers”** and its associated **Goal 7: “Engage the public in shaping and sharing the experience of exploration and discovery”**. The CaSGC has adopted this mission and goal for its Public Service Program. The following is a set of objectives derived from NASA’s Mission III and Goal 7:

Objective 1: The CaSGC will be a key conduit for information between NASA’s Research Programs and Missions and the California general public - UCSD, UC Davis, and UCLA have key projects with significant impacts in this area;

Objective 2: The CaSGC will provide aerospace-related content expertise to formal and informal STEM educational environments – Stanford, San Diego State, Astronomical Society of Pacific, and UC Berkeley have key projects with significant impacts in this area;

Objective 3: The CaSGC will partner with statewide, regional, and local public and private entities to enhance the aerospace-related economic, educational, and “Human Capital” development in California – UCSD, Stanford, Cal Poly, Santa Clara, and UC Santa Barbara have key projects with significant impacts in this area.

Starting in 1989, the CaSGC has taken the position that the Public Service Element would be best served by carefully “seeding” this program area with small amounts (<3%) of NASA Space Grant funds but considerably more people resources (faculty, students, and research staff). In 2003 & 2004 this strategy has resulted in a noticeable statewide impact and has influenced state and private investment toward the goals stated above.

The CaSGC Public Service Programs have provided an effective means of promoting an understanding of science, technology engineering, and mathematics (STEM) disciplines. The metrics used to determine success in the state are as follows: 1. Visits to websites; 2. Increases in the number of General Public and student participants; 3. Number of articles and features in the media; 4. Attendance at community projects. Partner organizations that derive most of their project funds from state, federal, and private sources have assessment and evaluation metrics govern by their sponsors.

The primary strength of the CaSGC Public Service Element is the use of websites to reach the public. The websites are very successful but this does not replace the hands-on events (student – mentor projects) and the community face-to-face interactions. The singular weakness is the limited human and funding resources that the CaSGC has to devote to the Public Service Program Element. We will continue our partnership strategy with local, regional, and statewide communities where the CaSGC provides only “seed” resources.

F. Sustaining Consortium Improvement

The 15th Year Evaluation and Improvement Plan process helped the CaSGC to recognize both its strengths and weaknesses. The CaSGC is very proud of its creative and novel approach to “Human Capital” development and private – public partnerships. The ongoing and growing human capital and research partnerships with NASA Dryden Flight Research Center (DFRC) and Ames Research Center (ARC) serve as models for NASA and the Nation. These CaSGC-lead efforts are impacting Space Grant Consortia across the country. In 2005, in partnering with the National and California Space Grant Foundations, the CaSGC is starting the process of replicating these programs at other NASA Centers.

The 15th Year Evaluation also provided insight into where the CaSGC could make improvements that uniquely support California’s needs in aerospace-related education and human capital development. The initial Improvement Plan structure addressed six areas and the following process has been put in place to sustain those initial actions:

1. Characterizing the unique California needs in each of the CaSGC Program Element areas;

The CaSGC will continue to document California's "needs and challenges" for aerospace-related programs in education, human capital (workforce) development, research, and public outreach by working with the California Council on Science and Technology, the California higher education systems' (UC, CSU, and CCC) systematic study, and the California Space Authority's Strategic Plan (**Aerospace-related Workforce, Education, Research, Infrastructure Assessment**). The CaSGC has made the decision to carefully apply its limited budget to program elements that produce a unique and significant impact on **California's aerospace-related human capital and research**.

2. Identifying the significant and unique contribution the CaSGC can make in each of these Program Element areas;

Annually, the CaSGC will be updating its Strategic Plan by mapping its goals, objectives, and outcomes against the evolving aerospace-related needs of California, NASA, and the nation. The CaSGC will continue to focus on two primary goals:

- **Goal 1.** – Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics (STEM);
- **Goal 2.** – Facilitate & coordinate partnerships between NASA Centers, aerospace industry, and academia for aerospace-related human capital development and research.

3. Clearly defining the CaSGC funding strategies and priorities for each Program Element, identifying the goals to be achieved, and documenting the unique CaSGC impacts, outcomes, and trends;

The CaSGC has developed a Strategic Plan that lays out a near-term Strategic Objectives outcomes as well as forecast to 2008. Each year the CaSGC will address these objectives and outcomes in terms of the changing aerospace landscape in California and the nation.

4. In Program Element partnerships (where CaSGC is a minor facilitating and coordinating partner), identifying the CaSGC's goals, specific roles and responsibilities, metrics for assessment and evaluation, and carefully document CaSGC specific impacts;

The CaSGC Goal 2 is specifically structured to deal with partnerships between NASA Centers, aerospace industry, and academia for aerospace-related human capital development and research. On an annual basis each of these partnerships will be evaluated against a set of metrics that compares projected outcomes against reality.

5. Addressing diversity issues in terms of California needs and demographics and stating the CaSGC specific goals and objectives, metrics for assessment, and specific impacts;

The STEM Diversity Analysis (see Appendix Section) sets an initial baseline for setting CaSGC objectives and outcomes. On an annual basis the CaSGC will continue to work with the California organizations that produce this information.

6. Clearly defining the assessment and evaluation approach (set of metrics) for consortium membership (adding and dropping affiliates).

The CaSGC has implemented an annual affiliate evaluation process that will determine the makeup of the membership of the CaSGC. A set of metrics have been published on the CaSGC website and it will be annually reviewed.